

## Ratios

Scientists use **ratios** to work out the formula for compounds.

Look at the diagram on the right. It shows the compound sodium chloride. There are 25 atoms of sodium and 25 atoms of chlorine. We can write this:

sodium:chlorine  
25:25  
1:1

The *ratio* of sodium atoms to chlorine atoms is 1:1. This is why the formula for sodium chloride is NaCl.

Look at the diagram on the right. It shows the compound calcium chloride. There are 12 atoms of calcium and 24 atoms of chlorine.

calcium:chlorine  
12:24  
1:2

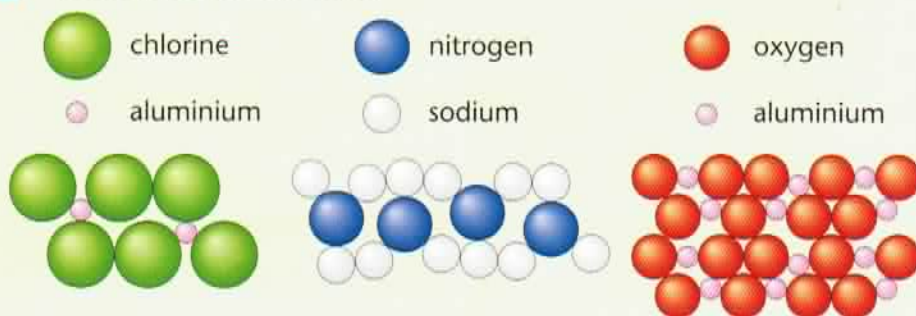
The ratio of calcium atoms to chlorine atoms is 1:2. This is why the formula for calcium chloride is  $\text{CaCl}_2$ .

Look at the diagram on the right. It shows the compound sodium oxide. There are 20 atoms of sodium and 10 atoms of oxygen.

sodium:oxygen  
20:10  
2:1

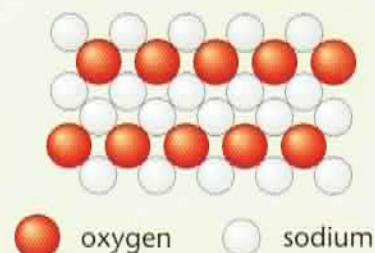
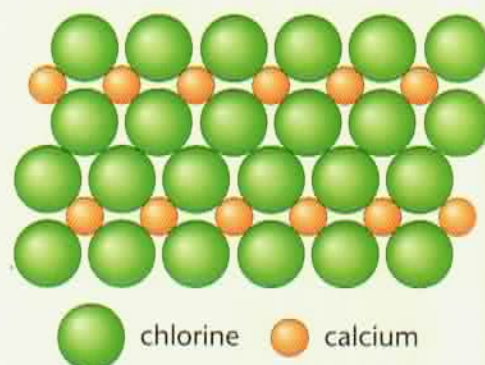
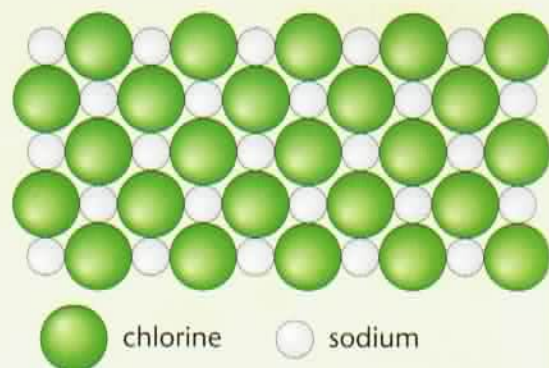
The ratio of sodium to oxygen atoms is 2:1. This is why the formula for sodium oxide is  $\text{Na}_2\text{O}$ .

**a** What is the formula for:



- (i) aluminium chloride?      (ii) sodium nitride?      (iii) aluminium oxide?

- b** (i) If some sodium chloride contained 20 million atoms of sodium, how many atoms of chlorine would it contain?
- (ii) If some sodium oxide contained 600 billion atoms of sodium, how many atoms of oxygen would it contain?



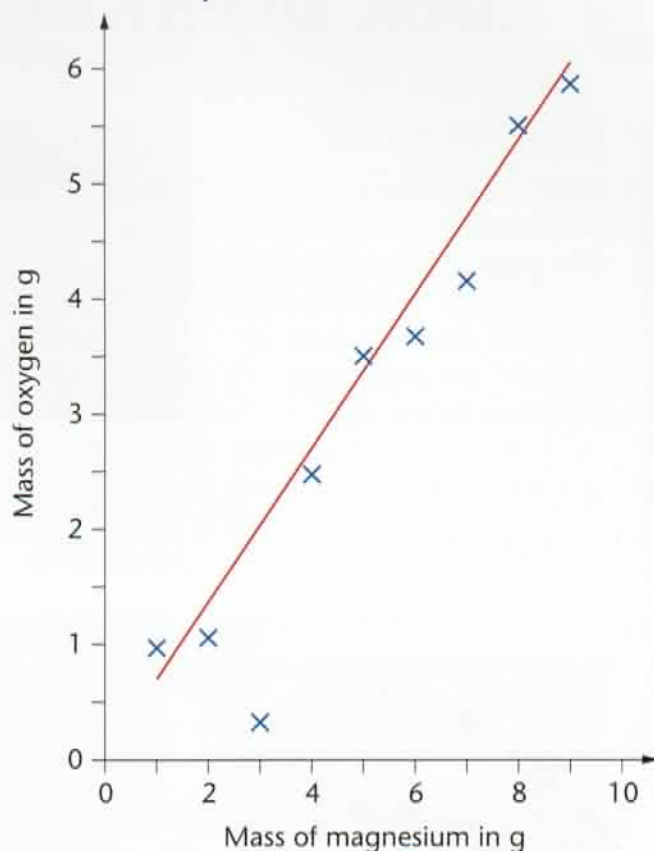
## Constant compound

Craig's class are doing an experiment. They are burning different masses of magnesium in air. They weigh the amount of magnesium oxide they make. They take great care to make sure that:

- all the magnesium is burned
- none of the magnesium oxide escapes.

They then work out the mass of oxygen that has reacted with the magnesium to make the magnesium oxide. Their results are shown in the table and the graph below.

Mass of magnesium in g	Mass of magnesium oxide in g	Mass of oxygen in g
1.00	1.92	0.92
2.00	3.09	1.09
3.00	3.35	0.35
4.00	6.41	2.41
5.00	8.52	3.52
6.00	9.71	3.71
7.00	11.18	4.18
8.00	13.49	5.49
9.00	14.83	5.83



**Which result does not fit in with the others?**

There is a straight line of best fit. This shows that the ratio of the mass of magnesium to the mass of oxygen stays the same. The composition of magnesium oxide is always the same.

- Using the graph above, how much oxygen reacts with:
- 3 g magnesium?
  - 6 g magnesium?
  - 9 g magnesium?

- What is the ratio of the mass of magnesium to the mass of oxygen?

24 units

16 units

*I thought the formula for magnesium oxide was MgO. That's a ratio of 1:1. The ratio of mass of magnesium to mass of oxygen is 3:2.*



*Well spotted! Magnesium atoms and oxygen atoms do not have the same mass. Magnesium atoms weigh more than oxygen atoms.*

## Questions

- Draw diagrams of these solids showing how the atoms may be arranged.
  - MgO
  - MgCl<sub>2</sub>
  - Mg<sub>3</sub>N<sub>2</sub>
- Some compounds contain molecules. Suggest and draw molecules for the following compounds.
  - SO<sub>2</sub>
  - CH<sub>4</sub>
  - C<sub>2</sub>H<sub>6</sub>
  - N<sub>2</sub>O
- Look back at the experiment carried out by Craig's class.
  - What was their input variable?
  - What was their outcome variable?
  - How did they work out the mass of oxygen that had reacted?
  - Suggest two reasons why the mass of oxygen reacting with 3 g of magnesium was low.